

HIGHLY SENSITIVE PRESSURE SENSOR AND INPUT DEVICE USING THE SAME

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This U.S. non-provisional patent application claims priority under 35 U.S.C. §119 to Korean Patent Application No. 10-2015-0132469 filed on Sep. 18, 2015, 10-2015-0179011 filed on Dec. 15, 2015, and 10-2016-0106845 filed on Aug. 23, 2016, the entire contents of which are hereby incorporated by reference.

BACKGROUND OF THE INVENTION

[0002] The present invention disclosed herein relates to a pressure sensor and input device, and more particularly, to a highly sensitive pressure sensor that may implement highly sensitive sensing with a simple configuration, and an input device using the same.

[0003] Demand for the development of various sensor technologies continues to increase due to the advent of the internet of things (IoT) era that connects things by using a digital technology. In particular, a touch/pressure sensor is a sensor that is widely used for most of daily things, such as flexible/wearable devices, robots, and health care as well as spaces closely connected with life, such as homes, factories, offices, and cars, but it has a limitation in that the costs of material and process are significantly high. The reason is that materials mostly used as electrodes so far, for example the prices of gold, silver, metal based nano wire, indium tin oxide (ITO), and carbon nano tube (CNT) are relatively high. Also, a study to form a micro-structure through the remodeling of the structure of a dielectric layer in order to increase the sensitivity of a pressure sensor in an existing parallel-plate capacitor structure is being actively conducted, but it is true that the cost of a process is significantly high because complicated processes, such as photo-lithography and etching are needed.

[0004] For this reason, most highly sensitive pressure sensors are staying in a study stage and fail to lead to commercialization. Thus, there is a need for the development of a new-concept high-performance pressure sensor that may overcome the limitation of an existing pressure sensor using a high-priced material and manufactured through a silicon process to minimize material and process costs.

PATENT LITERATURE

[0005] (Patent Literature 1) Korean Patent Publication No. 10-2012-0098749

SUMMARY OF THE INVENTION

[0006] According to various embodiments of the present invention, it is possible to provide an input device that uses a highly sensitive pressure sensor configured to be capable of being easily manufactured based on low-priced materials commonly used.

[0007] According to various embodiments of the present invention, it is possible to provide an input device that uses a highly sensitive pressure sensor for inputting various keys based on pressure by using the highly sensitive pressure sensor.

[0008] According to an embodiment of the present invention, there is provided a highly sensitive pressure sensor

including a lower substrate on which a first electrode having surface roughness is formed; an upper substrate on which a second electrode having surface roughness is formed; and a dielectric material stacked between the lower substrate and the upper substrate to be disposed between the first electrode and the second electrode.

[0009] The dielectric material may cover an uneven surface of the first electrode or the second electrode by the surface roughness of the first electrode or the second electrode.

[0010] The dielectric material may include elastomer, wherein weight percentage in the dielectric material of the elastomer may be determined according to the surface roughness and a thickness of the formed dielectric material.

[0011] The lower substrate or the upper substrate may be a flexible or stretchable material.

[0012] The surface roughness of the first electrode or the second electrode may be represented by surface roughness of the lower substrate or the upper substrate.

[0013] The surface roughness of the first electrode or the second electrode may be generated when an electrode is formed or generated by processing after the electrode is formed.

[0014] The dielectric material may include a lower dielectric layer that the first electrode has; and an upper dielectric layer that the second electrode has.

[0015] The lower dielectric layer may be in close contact with the first electrode to allow the surface roughness of the first electrode to be represented on the lower dielectric layer, and the upper dielectric layer may be in close contact with the second electrode to allow the surface roughness of the second electrode to be represented on the upper dielectric layer.

[0016] An air layer may be formed in a portion of a region between the lower dielectric layer and the upper dielectric layer.

[0017] An interlocked structure may be formed by engaging of at least a portion of surfaces of the lower dielectric layer and the upper dielectric layer, in a case where pressure is applied to at least one of the lower substrate and the upper substrate.

[0018] The air layer formed between the lower dielectric layer and the upper dielectric layer may be removed or divided into smaller air layers based on the interlocked structure, in a case where pressure is applied to at least one of the lower substrate and the upper substrate.

[0019] According to another embodiment of the present invention, there is provided an input device using a highly sensitive pressure sensor, the input device including at least one highly sensitive pressure sensor of any one of claims 1 to 11; and a control unit that handles a designated key input according to a signal output from the pressure sensor with respect to applied pressure when pressure is applied to the highly sensitive pressure sensor.

[0020] The input device may further include a pressure application unit that applies pressure to one or more of the lower substrate or the upper substrate.

[0021] The control unit may be configured to: handle as a first signal in a case where the applied pressure is lower than a first reference pressure that is preset, and handle as a second signal in a case where the applied pressure is equal to or higher than the first reference pressure.